OKLAHOMA
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
STILLWATER, OKLAHOMA

Suggestions Relative to the Boll Weevil

By C. E. SANBORN, *Entomologist*

Circular No. 53.

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The 1921 crop of boll weevils was perhaps the largest ever produced in Oklahoma. The line A-A on map, Fig. 1, shows the total area which was infested in 1921 as charted by the U. S. Bureau of Entomology. The line B-B shows the northern boundary of badly infested cotton. The line C-C shows the northern boundary line of severely infested cotton in Oklahoma.

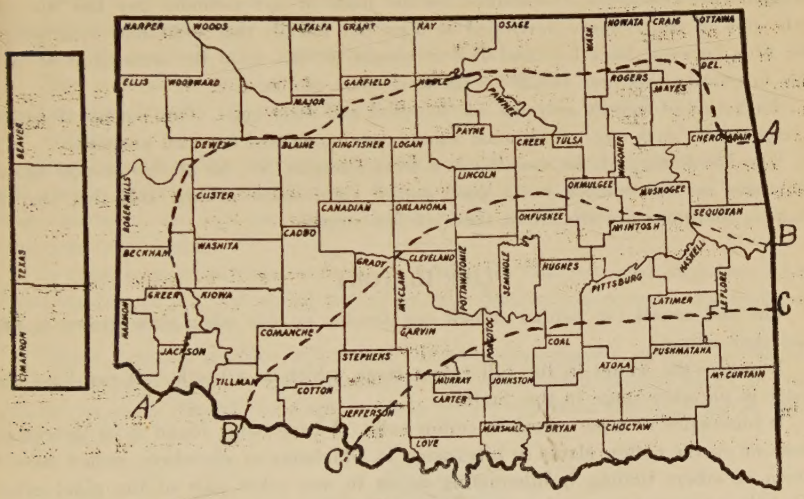

Figure 1

Our experiments which were carried on during the fall of 1921 and the spring of 1922 indicate that the winter was an ideal one for weevil hibernation.

Screen wire cages, two feet square by six feet long, were prepared for testing the winter mortality of the weevils. In these cages were placed such materials as could be found in and near cotton fields in which weevils might hibernate. The grass, cotton stalks, bolls of cotton, corn fodder, weeds, wood, straw and brush which were used practically filled each cage. Soon after the field cotton was completely destroyed by frost, weevils were placed in the cages as follows:

November 12th, 82 placed in cage at Antlers.

December 6th, 100 placed in cage at Durant.

December 7th, 100 placed in cage at Marietta.

December 8th, 100 placed in cage at Stillwater.

The weevils, dead and alive, were collected from these cages and counted during the middle of March, 1922.

The Antlers cage was the only one in which any live boll weevils were found. The test showed that sixty were dead, twenty-one were unaccounted for, probably destroyed by spiders, and one was alive.

It was apparent that during the early part of the winter the weevils were dissatisfied in all of the cages and instead of seeking safe retreats for the winter, continued to worry themselves in trying to escape. It is obvious that the mortality in the cages was far greater than under normal conditions of weevil freedom.

Under artificial or cage conditions, it is shown that 1.29 percent lived through the winter at Antlers. It is believed that much greater percent lived through under the natural and unhampered conditions of good cover in the open country.

In figuring on a two percent basis of overwintering weevils, it is found that if the cotton acreage is to be the same as for last year that there will be one pair of weevils per ten stalks of cotton (south of line C-C, Fig. 1) to begin with this spring. This conclusion is obtained on the basis of our estimate last fall that on each stalk of cotton there developed at least ten weevils that went into hiebrnation. The area between lines C-C and B-B is almost as bad from the standpoint of possible infestation this year (1922) as the area south of line C-C.

Each pair of weevils may lay one hundred and forty eggs. One square of cotton is required for each egg. Additional squares are punctured for food purposes.

The life history of the weevil taken from Circular No. 50 of this station shows that there is little chance for a good cotton yield south of line B-B this year if summer conditions are similar to those of last summer.

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LIFE HISTORY

The boll weevil can neither subsist nor develop on any other plant grown in the State than cotton.

It passes the winter in the full grown stage, which is a beetle. It can pass the winter in no other stage in this State.

It hibernates to some extent in cotton bolls. I have never found it in the cotton plants or on the cotton plants in hibernaion in Oklahoma or elsewhere, neiher have I known of others finding it hibernating on or in any other part of the plant other than bolls excepting in stored cotton or cotton seed.

About the time of the first killing frost, the adult weevils fly from he cotton fields seeking protection in such places as will furnish shelter from moisture especially, and also low temperature.

Immature weevils are easily destroyed by the freezing of the bolls, consequently development is discontinued as soon as the cotton plants are severely singed with frost.

The hibernating weevils begin to appear normally at the time when the young cotton plants are beginning to appear in the newly planted fields. The hibernating weevils do not all issue at once but continue to come forth possibly until the month of July. The early issuing weevils feed on the tender young leaves of the plants and later, on the developing squares.

In the developing squares and young bolls, the females deposit the eggs in punctures made by their beaks. A set of teeth is in the end of the beak.

The punctures made for the reception of the eggs are very similar to the punctures made in the squares by the weevils for food purposes.

Rarely more than one egg is deposited in one square.

When the weevils become numerous and the squares become scarce, the females will lay eggs in the developing bolls.

Often more than one egg is deposited in a single boll when the weevils are numerous and the bolls are scarce. As many as a dozen eggs may be deposited in a single boll.

The females may deposit as many as one hundred and forty eggs each.

The egg hatches into a larve within two or three days.

The larva, grub or maggot as it may be called is footless and develops only inside square or boll and in a period of from seven to twelve days.

The pupal stage, or transitional stage of the larva to the adult, takes place in the cavern of the square or boll made by the larva in obtaining its food. This stage requires from three to five days.

The total length of time required, therefore, is between two and three weeks for complete development.

The time required for a generation is about six weeks.

Three to four generations can develop in this State in one season.

The total progeny of one pair may amount to between four and five millions of boll weevils.

Much confusion has arisen among cotton planters concerning the identity of the boll weevil. Notwithstanding the fact that authentic statements have been repeatedly made relative to the food and winter habits of this pest, persons sometimes arrive at erroneous conclusions.

In order to prevent some confusion in the future that has been abundant, I have drawn outlines of the boll weevil and other bugs that have been most commonly supposed to be boll weevils.

Figure 2 is the genuine boll weevil (*Anthonomus grandis*, Boh.). It develops in no other plant than the squares and bolls of cotton. It is greyish brown in color, and can be easily identified by the presence of two spines on the front leg as shown at a, Fig. 2.

Figure 2—Boll Weevil

Figure 3 is the blood weed weevil (*Lixus scrobicollis*, Boh.). During the growth of the blood weed, the adult weevil deposits an egg in the main stalk thereof. The egg hatches into a worm which feeds in the pith of the weed. During the latter part of the summer, the worm transforms through a pupal stage into the dark colored adult beetle which remains in the blood weed until the following year.

Gigure 4 is the Transverse baris (*Baris transversa*, Say.) and is commonly known as the cocklebur weevil. The adult weevils are black, and lay eggs in the base of

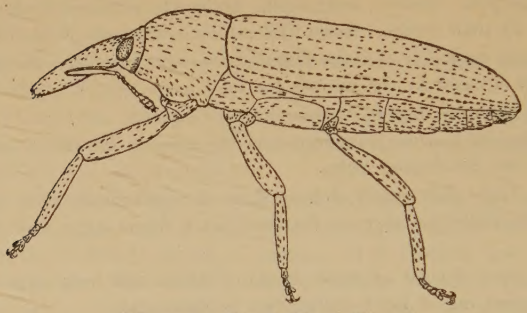

Figure 3—Blood Weed Weevil

the cocklebur. Larva hatching from the eggs feed in the plants and develop mainly in the tap root near the crown. The adults pass the winter in the cocklebur root and stem.

Figure 5 is the potato stalk borer (*Trichobaris trinotata*, Say.). It is white except for a few black spots as shown in the figure, and develops in jimson weeds and similar weeds and Irish potato stalks. Its life history is similar to the blood weed weevil.

Figure 4—Transverse Baris

Figure 5—Potato Stalk Borer

Figure 6. Cottonwood weevil (*Dortymus mucidus*, Say). It hibernates beneath the rotten bark or in similar protected places on or near cottonwood trees. This bug has the same color and more closely resembles the boll weevil than any other species in Oklahoma.

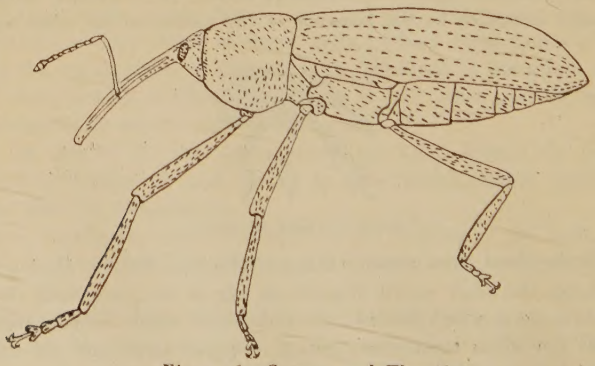

Figure 6—Cottonwood Weevil

Figure 7 is a cotton sharp shooter (*Oncometopia undata*, Fab.). This bug does not resemble the boll weevil and does little or no damage to cotton. It is, however,

frequently prevalent in cotton fields near wooded areas and consequently often mistaken for the boll weevil.

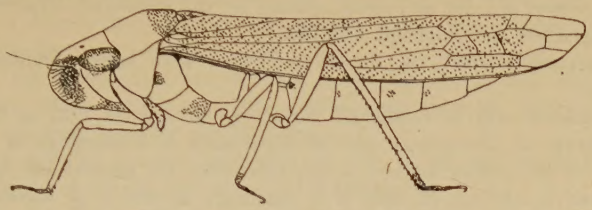

Figure 7—Cotton Sharp Shooter

COTTON CULTURE

The advice relative to cotton culture is as follows:

1. Plant no more cotton than can be thoroughly cultivated.
2. Plant an early maturing variety.
3. Plant on the best kind of a cotton seed bed, just as soon as the ground is warm enough to permit the plants to grow nicely.
4. Cultivate often. The middles should be left lower than the rows. A perfect soil mulch should be maintained. The soil surface should be kept smooth and weedless. The maximum amount of sunshine on smooth, weedless ground will give a maximum drying condition for fallen squares. This is desirable in order to prevent continuous weevil development.

From a practical and scientific standpoint, we advise that cotton plants be destroyed one month before the occurrence of the first killing frost in the fall of the year. This brings about either a forced hibernation or death from starvation on the part of the boll weevils.

Experiments show that where 43 percent of the weevils can live over under normal conditions of hibernation ,only 3 percent can live over winter under this forced method of hibernation.

It matters not how the cotton plants are destroped, provided they are destroyed at the time above mentioned. They may be either plowed under, or uprooted, piled and thus for a short time act as a trap in which the adults may collect, then as soon as the leaves are dry enough they my be burned, thus destroying them. The roots and main stalks do not need to be consumed by fire. Enough heat will be generated by the burning of the leaves, under proper methods of burning, not only to destroy all weevils present but prevent further development.

The pasturing of cotton stalks is not advisable as a weevil control since a second growth, sometimes known as seppa cotton, develops near the base of the plant on which weevils can subsist along with the stock that may be using the cotton fields for pasture.

The next phase of procedure is proper preparation of a seedbed for the following crop of cotton. This depends largely upon local conditions and is well known to all county agents and practically all cotton growers.

POISON TREATMENT

The methods given in U. S. Bureau of Entomoogy Bulletin No. 875 for poisoning the boll weevil are not as present advised by the Oklahoma Experiment Station as being satisfactory for Oklahoma conditions.

The experiments which the Bureau conducted were under conditions very different to ours.

Demonstrations will be conducted during the summer of 1922 in Oklahoma by the U. S. Bureau of Entomology and the department of Entomology of this Station, but the use of the poison method is not sanctioned for general use by Oklahoma authorities and it will not be until it is absolutely known to be satisfactory under Oklahoma conditions.

Insecticide and dusting machine dealers should consider these facts, and not attempt to market their products any more rapidly than is justifiable to the farmers.

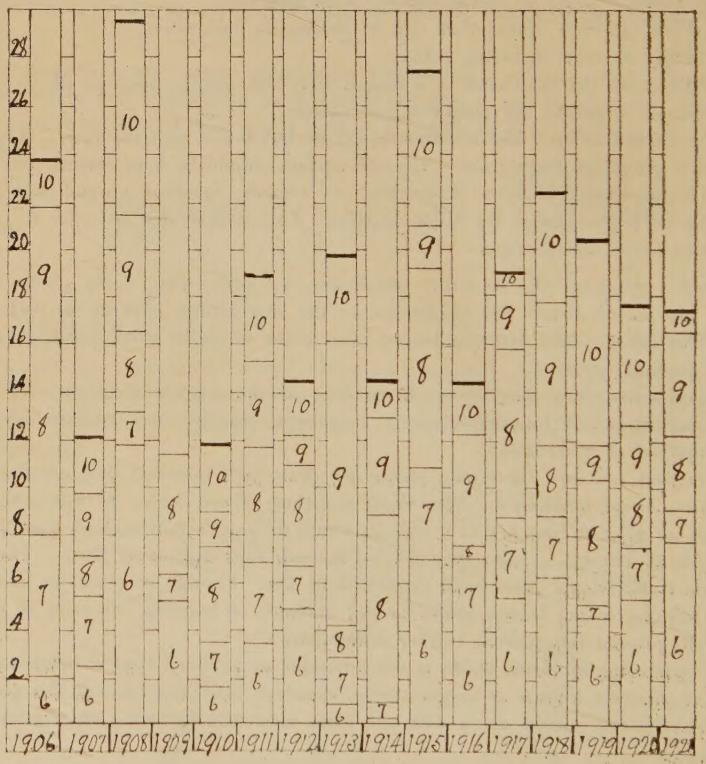

Figure 8—Rainfall from 1906 to 1921

WEATHER CONDITIONS FAVORABLE AND UNFAVORABLE FOR WEEVIL

Given: A dry, moderate winter such as the past winter has been. A maximum number of weevils will survive.

Given: A wet and severely cold winter. Only a minimum number of weevils will survive.

In the extreme northern part of the boll weevil infested area, there will be no weevils able to survive the extremly cold and wet winter, while farther south where the weather for the same winter becomes milder, a few will survive.

However, the damage that may be done by the boll weevil does not entirely depend upon the winter conditions. The damage also depends upon summer conditions. For instance, consider the following:

Given: A dry, hot summer, especially one that is dry and hot during the time that the first brood of weevils is in process of development.

No matter if a large number does survive the previous winter, there could be no serious damage by later broods if the first broods fail to develop on account of the dry, hot weather.

Given: A damp, cool summer, especially during the time for the development of the first brood and second brood of weevils.

The result will be that they can multiply rapidly and do great damage.

Map, Figure 8, shows the rainfall (with few exceptions) for the months of June, July, August, September and October at McAlester from 1906 to 1921 inclusive. Rainfall is designated by inches in figures on the left of the figure and by years at the bottom of the same. For instance, the rainfall for the months mentioned of the years 1921 was: June 7.85 inches, July .68 inch, August 3.69 inches, September 4.40 inches and October .19 inch. (Each month is designated in the figure by its number.)

The map, Figure 9, shows the area of Oklahoma infested at the close of each crop year. This data has been obtained each year by entomoligists of the U. S. Bureau.

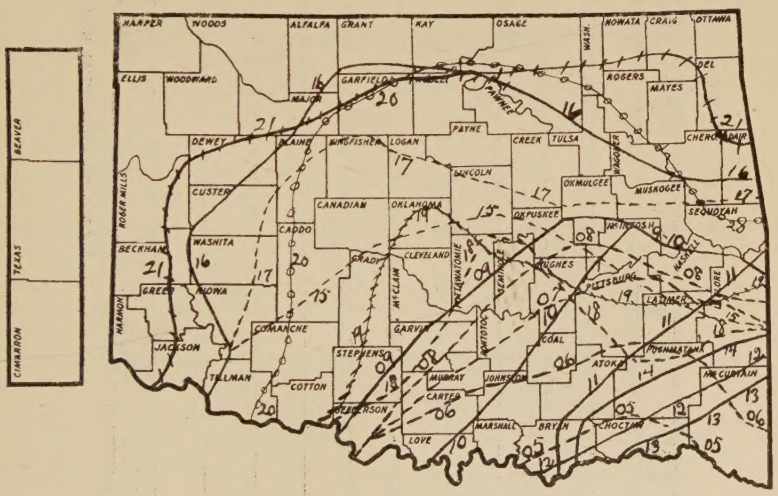

Figure 9—Progress of Infestation

By observing this map, it will be noted that the area of infestation lies in a southernly direction in any year from the line correspondingly numbered for the year. For instance, the dotted line '05 is the boundary line of the area of the first year of infestation in Oklahoma. The crossed line '21 is the boundary line of the infested area at the end of the summer of 1921.

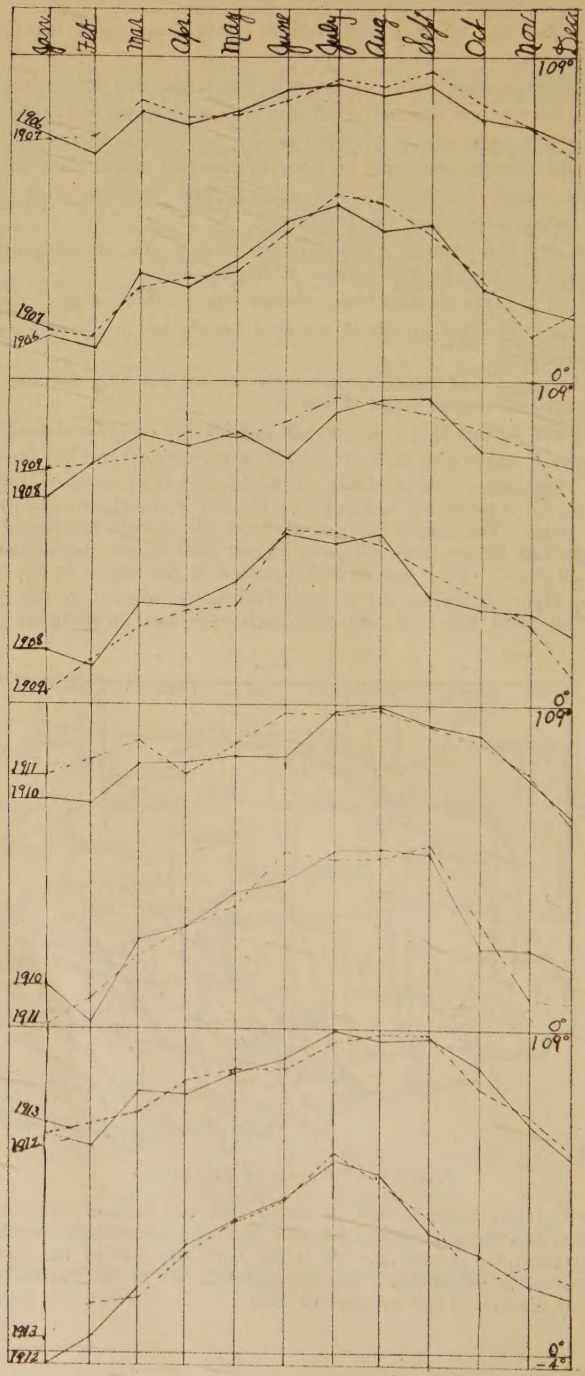

Figure 10—Maximum and Minimum Temperatures

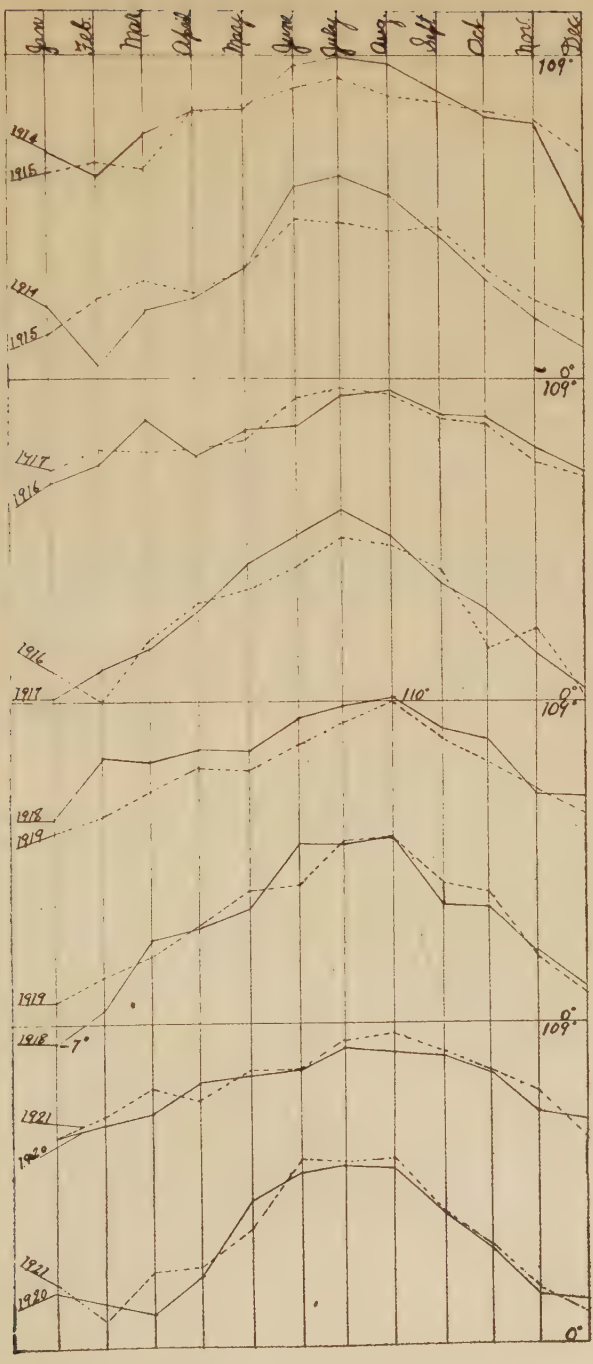

Figure 11—Maximum and Minimum Temperatures

The two figures, 10 and 11, show the monthly maximum and minimum temperature for years 1906 to 1921 inclusive. This data is taken from the U. S. Weather Bureau reports from McAlester, Oklahoma.

The report from January to June inclusive for year 1906 was blank, so in order that the curve might be complete, an average temperature of the succeeding years to 1921 is inserted. The same is likewise true for August and September 1909. The temperature for July, August, November and December were not available and substitutions are also inserted in like manner for year 1921.

Each figure is divided into four sections. In each section is presented curves for two years. Each section also represents a temperature 0° to 109° Fahrenheit. Only three times did the temperature go outside these limits. In January, 1912, is a record of minus 4° (Figure 10) and 1918 (Figure 11) the highest and lowest temperature since 1906 is recorded. The lowest temperature being minus 7° in January and the highest 110° in August.

A brief comparison of the temperature as shown in Figures 10 and 11 and the rainfall as shown in Figure 8 with the annual dispersion of the weevil as indicated in Figure 9 will give the relationship of the weather to the spread of the weevil into Oklahoma as indicated by the boundary line for each year from 1905 to 1921 inclusive.

A close study of the rainfall for certain summer months along with the temperature for that time as well as the temperature for the preceding winter will reveal some interesting conclusions pertaining to location of the boll weevil boundary line for the fall of that summer.

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2 Factors Affecting Setting of Fruit on the Tomato.
4 A Study in Inheritance of Black Hulled White Kafir.
5 Effect of Lime and Organic Matter on the Impervious Kirkland Upland Soil.
6 Corn Plant Louse.
7 Sheep Breeding.
8 The Development of Fruit Buds.
9 Cowpea Aphis.
10 The White Ant.
12 Reproduction of Queen Bees.
14 A Chemical Study of the Grain Sorghums.
16 The Composition and Properties of Silage Prepared from the Grain Sorghums.
19 Effect of Various Feeds upon the Quality of the Pork Product.
20 Fish Moth.
21 Artificial Fertilization of Queen Bees.
22 Round Worms and Tape Worms of Poultry.
65 Chemical Changes which Take Place in Cottonseed During Growth and Factors Affecting Same.
75 Lung Worms in Sheep.
104 Nodular Worms in Sheep.

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23 Increasing Weight of Brown and White Eggs.
24 The Marketing of Dairy Products in Oklahoma.
25 Factors Influencing Grade of Butter.
26 Studies in Cheese Making.
27 Bacteriology of Butter.
28 Bacteriology of Ice Cream.
31 A Study of the Bacteria which is Found to be the Cause of Honey Bee Paralysis.
32 False Chinch Bug.
33 Apiculture.
36 Protein Supplement for Kafir.
38 Sources of Protein for Poultry Feed.
39 A Study of Immunization of Cattle Against Blackleg by Using Aggressins Manufactured in the Laboratory, Also a Study of Immunity Produced by Using Powder Vaccine of Double Strength.
40 Costs and Production in Advanced Registry Dairy Cow Testing.
41 Methods of Determination of Butterfats in Ice Cream.
42 Bean Diseases.
43 Pecan Investigations.
44 Variety Test of Orchard Fruit.
45 Variety Test of Vegetables.
46 Variety Test of Beans.

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48 Bush Fruits.
49 Variety Test of Grapes.
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51 One and Two Year Old Tree Test.
53 Influence of Range of Egg Laying on Fertility, Hatchability and Egg Laying of Offspring.
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55A Cultural Experiments—Wheat.
55B Continuous Culture—Cotton, Kafir, Oats.
55C Cultural Experiment with Kafir Corn.
56A Variety Tests—Corn.
56B Variety Tests—Oats.
56C Variety Tests—Cotton.
56D Variety Tests—Wheat.
56E Variety Tests—Cowpeas.
56F Variety Tests—Grain Sorghums.
56G Variety Tests—Sweet Sorghums.
57A Crop Rotation and Fertility.
57B Crop Rotation and Fertility—Small Grain Fertility Rotation.
57C Crop Rotation and Fertility—Bottom Land Rotation.
57D Crop Rotation and Fertility—Alfalfa Fertility.
59 Plant Breeding.
60A Miscellaneous—Peanuts, Sorghums, Legumes.
60B Miscellaneous—Kafir and Cowpea Experiment.
60C Miscellaneous—Rate of Planting Kafir.
60D Miscellaneous—Sudan Rate and Date Test.
62 Farm Management Survey of Canadian and Other Counties in Oklahoma.
63 Sweet Clover Investigations.
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85 Effects of Animal Proteins on Winter Egg Production.
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105 Insect Control.
106 Beef Production.
107 Swine Investigations.

No.
108 Swine Investigations—Amount of Mineral Necessary for the Maximum Development of Bone in Swine.
109 Fattening Lambs.
110 Use of Purebred Rams.
111 Artificial Illumination.
112 Incubation.

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List of Available Publications

BULLETINS

No.
35 Summary of Digestion Experiments with Kafir.
36 Summary of Experiments with Corn and Wheat.
67 Miscellaneous Water Analyses.
75 A Study of the Bacterial Contents of Cream.
88 The Southern Plum Aphis.
101 Silos in Oklahoma.
103 Sudan Grass.
104 Hog Cholera.
105 Cowpea Culture.
107 Using the Babcock Test.
109 The Alfalfa Web Worm.
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113 The Locust Borer.
115 Sudan Grass Silage.
116 The Sycamore Lace Bug.
118 The Chicken Tick.
119 Report of Experiments on Immunization Against Hog Cholera.
120 A Preliminary Report of Feeds for Fattening Pigs.
121 Experiments with Bolly Refuse.
122 A Study of the Cyanogenesis in Sorghum Vulgare.
124 Effect of Feeding Peanuts on the Quality of Pork.
125 Comparative Rations for Wintering Breeding Ewes.
127 Darso.
128 The Crow.
129 The Four-Spotted Cowpea Weevil.
130 The Chicken Sticktight Flea.
131 Technical Study of the Bacterial Blight of Beans.
132 The Composition and Digestibility of Sudan Grass Hay, Darso, Darso Silage, Broom Corn Seed and Sunflower Silage.
133 Sheep Feeding Investigations: Comparative Rations for Fattening Lambs.
134 Cattle Feeding Investigations: Comparison of Results in Fattening Calves on a Ration of Sunflower Silage, Ground Corn, Cottonseed Meal and Alfalfa Hay with Results of a Ration Containing Darso Silage, Ground Corn, Cottonseed Meal and Alfalfa Hay.
135 A Chemical Study of Broom Corn and Broom Corn Silage.
136 Sheep Feeding Investigations: Comparative Rations for Wintering Breeding Ewes.
137 Stomach Worms in Sheep.
138 Alfalfa Experiment.
139 Cattle Feeding Investigations: Comparative Value of Silage for Making Beef. Silages Used, Sunflower, Corn, Kafir, Cane and Darso.
143 The Effect of Lime and Organic Matter on the So-Called Hardpan Subsoils.
144 Effect of Protein and Mineral on the Development of Swine.
145 Oats. Rotation vs. Continuous Culture.

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8 The Spring Grain Aphis.
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40 Cotton Anthracnose.
43 Information for Horse Breeders.
47 4th and 5th Annual Reports for the years 1919 and 1920 by the Oklahoma Livestock Registry Board.
48 Winter Treatment for Honey Bees.
50 Boll Weevil: Life History with Essential Methods of Control.
Twenty-Sixth Annual Report of the Experiment Station. June 1917.
Twenty-Seventh Annual Report of the Experiment Station. June 1918.
Twenty-Ninth Annual Report of the Experiment Station. June 1920.
Thirtieth Annual Report of the Experiment Station. June 1921.
New Facts for Oklahoma Farmers. Thirty-First Annual Report of the Experiment Station. June 1922.